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3 Preliminary

3.1 General

The following series of articles provides a set of guidelines for development of type, size, and location (TS&L) plans. TS&L plans are of two types: (1) Preliminary Situation Plans for bridges, walls, and culverts that require final design and (2) Pipe Plat Plans for pipe culverts. Within the guidelines and throughout the development of TS&L plans it is important that the designer apply sound engineering judgment, including technical and economic analysis.

This series of articles replaces the applicable articles of the 2000 edition of *Guidelines for Preliminary Design of Bridges and Culverts*. These guidelines provide a partial update of the 2000 edition.

3.1.1 Policy overview

Within the Office of Bridges and Structures, the preliminary bridge design section develops the preliminary layouts for highway structures. For bridges, walls, culverts, and miscellaneous structures that require final design, the section assembles information and develops a preliminary situation plan sheet so that a designer in one of the final design sections can perform the structural design and develop final plans for a contract letting. For pipe culverts the section develops the layout in sufficient detail that the Office of Design can reference the information on their final road plans for a contract letting.

The development of all preliminary structure plans includes a number of tasks such as:

- Analyzing hydrology and hydraulics;
- Analyzing road geometrics;
- Determining the type, size, and location of structures;
- Developing a layout in the CADD system;
- Attending field reviews;
- Coordinating with other Iowa DOT offices, public entities, and outside agencies;
- Estimating cost alternatives;
- Obtaining flood plain permit approvals; and
- Coordinating with other regulatory agencies.

The tasks are outlined below, first for bridges and then for culverts.

{List of tasks will be added in the future.}

3.1.2 Design information

The designer will need to access information from several sources to perform preliminary design, including the following:

- Plans for existing structures, including as-built plans, from Electronic Records Management System (ERMS);
- Bridge maintenance reports from ERMS and SIIMS;
- A new site survey from Office of Design;
- Soil boring information from the Office of Design;
- Aerial photographs from the Office of Design and/or web sites;
- Aerial agricultural photographs (drainage maps) from the Photogrammetry/Preliminary Survey Section in the Office of Design;
- Topographic maps from the Office of Bridges and Structures, the Office of Design and/or web sites; and
- Field exams.

Plans for existing structures will give a good indication of the site when an existing structure was built, widened, and/or extended, and comparison with a new survey will indicate any site changes that have occurred since previous construction.

The designer should make appropriate use of CADD to integrate support programs such as Geopak and GeoMedia when developing type, size, and location (TS&L) plans.

3.1.3 Definitions

~~AutoBridge is software that links Excel, Word, and MicroStation to automate various aspects of bridge design and detailing for constant width and multiple span pretensioned prestressed concrete beam bridges.~~

Berm slope location table (BSLT) gives toe and top of berm information to aid the contractor in construction of the berm.

Bicycle lane or **bike lane** is a portion of a roadway which has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists.

Detailed Flood Insurance Study (FIS) analysis of a community's flood prone areas which determines the 100 year flood elevation and floodway for certain streams.

Electronic Reference Library (ERL) contains plans, specifications, and manuals and is available on the Iowa Department of Transportation's web site.

Electronic Records Management System (ERMS) has been developed to enable electronic use and management of documents within the Iowa Department of Transportation. ERMS includes aerial photographs, existing bridge plans, bridge inspection records, and other documents useful for preliminary bridge design.

Floodway is the portion of the floodplain that must be left unobstructed for the conveyance of the 100 year flood.

Flood Risk Reduction Project (FRRP) is typically defined as a Corps of Engineers designed flood protection levee system.

Grading surface is defined by key points on the Berm Slope Location Table [BDM 3.2.7.3.3].

Green book is the office term for the Office of Design's manual of Road Design Details.

Ordinary high water mark means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other

appropriate means that consider the characteristics of the surrounding areas [Code of the Federal Register 33 CFR Part 328.3].

Red book is the office term for the Office of Design's manual of Standard Road Plans.

Revetment is a relatively general term for a facing that supports an embankment. **Riprap** is a more specific term for the layer of various sized rocks or broken concrete used to protect a streambank from erosion. With respect to streambank protection the terms **revetment** and **riprap** usually are interchangeable. **Revetment Stone** is the quarry industry's product that may be used for streambank erosion protection.

Section Leader is the supervisor of the Office of Bridges and Structures preliminary bridge section, final design section, or consultant coordination section.

Shared use path is a bikeway physically separated from motorized vehicular traffic by an open space or a barrier and either within the highway right-of-way or within an independent right-of-way. Shared use paths may also be used by pedestrians, skaters, wheelchair users, joggers, and other non-motorized users. See AASHTO's 1999 *Guide for the Development of Bicycle Facilities* [BDM 3.1.5.2].

Typical is the office term for a Road Design Detail.

3.1.4 Abbreviations and notation

3R, Resurfacing, Restoration, Rehabilitation; a series of terms that refers to a Federal Highway Administration highway project funding program

ADT, average daily traffic

AREMA, American Railway Engineering and Maintenance-of-Way Association

B0, [event code for Office of Bridges and Structures concept](#)

B1, [event code for Office of Bridges and Structures layout](#)

B2, [event code for structural/hydraulic design plans to Office of Design](#)

BTB, BTC, BTD, BTE, standard cross sections for pretensioned prestressed concrete bulb tee beams

BNSF, Burlington Northern Santa-Fe Railway

BSLT, berm slope location table

CCS, continuous concrete slab

CFR, Code of Federal Regulations

CLOMR, Conditional Letter of Map Revision issued by FEMA

CMP, corrugated metal pipe

CWPG, continuous welded plate girder

D₅₀, median revetment stone diameter

D0, [event code for predesign concept](#)

D2, [event code for design field exam](#)

DA, drainage area

ERL, Electronic Reference Library

ERMS, Electronic Records Management System

FEMA, Federal Emergency Management Agency

FHWA, Federal Highway Administration

FIS, Flood Insurance Study

HDPE, high density polyethylene

HEC-2, U.S. Army Corps of Engineers Hydrologic Engineering Center hydraulic analysis software

HEC-RAS, U.S. Army Corps of Engineers Hydrologic Engineering Center – River Analysis System hydraulic analysis software

IAC, Iowa Administrative Code

IFI, intermediate foundation improvement

IHRB, Iowa Highway Research Board

Iowa DNR, Iowa Department of Natural Resources

Iowa DOT, Iowa Department of Transportation

LOMR, Letter of Map Revision issued by FEMA

LT, left

M, distance between chord and arc at midpoint of horizontally curved bridge [BDM 3.2.6.3]

MCS, main-channel slope, a variable in USGS WRIR 03-4120

MSE, mechanically stabilized earth, generally associated with retaining walls

N or N-value, standard penetration test number of blows per foot (300 mm). N also may be given as SPT NO, the Standard Penetration Test Number in the soils information chart.

n-coefficient, Manning's Coefficient [BDM 3.2.2.3]

NFIP, National Flood Insurance Program

NHS, National Highway System

NRCS, Natural Resources Conservation Service

PE, preliminary engineering

PEP, polyethylene pipe

POT, point on tangent

PPCB, pretensioned prestressed concrete beam

Q₂, Q₅₀, Q₁₀₀, Q₅₀₀, estimated channel discharge at 2-, 50-, 100-, or 500-year design flood frequency

RBLT, recoverable berm location table

RCB, reinforced concrete box, a type of culvert

RCP, reinforced concrete pipe

ROW, right of way

RSB, rolled steel beam

RSS, reinforced steepened slope

RT, right

SI&A, Structure Inventory and Appraisal

SIIMS, Structure Inventory and Inspection Management System

SUDAS, (Iowa) Statewide Urban Design and Specifications

TS&L, type, size, and location

UP or UPRR, Union Pacific Railroad

USGS, United States Geological Survey

WSPRO, water surface profile software developed by the U.S. Geological Survey

3.1.5 References

3.1.5.1 Direct

[IDOT PPM policy number] refers to a policy in the Iowa Department of Transportation *Policies and Procedures Manual*.

[IDOT SS article] refers to Iowa Department of Transportation *Standard Specifications for Highway and Bridge Construction, Series 2009* with article number. (Available on the Internet at: <http://www.iowadot.gov/erl/index.html>)

[OD DM article, table, or figure] refers to the Office of Design, Highway Division *Design Manual* with article, table, or figure number. (Available on the Internet at: <http://www.iowadot.gov/design/dmanual/manual.html?reload>)

[OD RDD sheet number] refers to the Office of Design, Highway Division "Road Design Details" with sheet number. Formerly the detail manual was referred to as the "green book." (Available on the Internet at: <http://www.iowadot.gov/design/desdet.htm>)

[OD SRP sheet number] refers to an Office of Design, Highway Division "Standard Road Plan" with sheet number. Formerly the plan manual was referred to as the "red book." (Available on the Internet at: <http://www.iowadot.gov/design/stdrdpln.htm>)

3.1.5.2 Indirect

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generally should be designed to ensure that the 100-year flood elevation is not greater than the outside edge of shoulder. However, the designer should recognize that if the road grade is much higher, road grade overflow will not serve as a relief valve for the bridge during an extreme flood.

Changes to existing primary road profile grades on bridge replacement projects also need careful consideration. The designer should ensure that raising profile grades in areas with a history of roadway overtopping does not have a negative impact to adjacent property owners.

Coordination of the road grades with the Office of Design may be required.